TUNABLE PULSED LASERS

Integrated Nd:YAG pumped type II BBO OPO laser systems

2020

Litron Lasers

Aurora II Integra

Innovative, Type II BBO OPO and Nd:YAG pump laser integrated into a single system

FEATURES

- *Fully integrated Q-switched pump laser and OPO*
- *Continuous tuning range of 410 – 2600nm*
- *Pulse energies up to 45mJ*
- *< 4cm^{-1} linewidth in the visible range*
- *Repetition rates up to 100Hz*
- *Motorised OPO wavelength tuning*
- *Simultaneous signal and idler access*
- *355nm pump process shutter and energy monitoring*
- *No user-alignment required*
- *Full PC control*

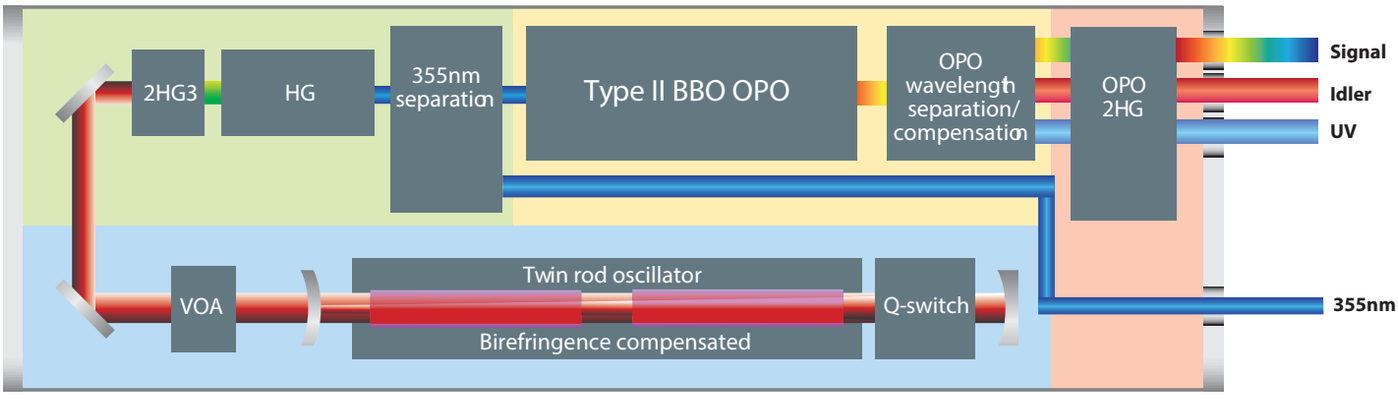
The **Aurora II Integra** range of type II BBO OPOs has been designed with reliability, stability and ease of use in mind. The OPO and pump source are supplied as a fully integrated single and matched source solution. This allows researchers to concentrate on their experiments and industrial system integrators the peace of mind that their process will be consistent and robust. With a wide choice of integrated and optimised Nd:YAG pump lasers from 10Hz to 100Hz, these are truly flexible systems.

The Aurora II Integra builds on this with fully featured computer control of both the pump laser and OPO which allows ease of use and simple system integration. Integrators will benefit from the unprecedented flexibility and usability of this system. Researchers will appreciate its modularity and how the many possible upgrades can support their changing research objectives.

OPTIONS INCLUDE

- *UV harmonic option for 210 – 410nm*
- *Spectrometer for wavelength measurement and automatic tuning*
- *1064nm variable optical attenuator*
- *Access to 1064nm and 532nm 2nd harmonic via side ports*
- *Access to 355nm pump output via the front panel*
- *Variable repetition rates*
- *532nm pumping for high energy 670 – 2600nm operation*

Aurora II Integra Type II BBO OPO Unit Schematic View



Twin rod Nd:YAG oscillator and variable attenuator

532nm and 355nm harmonic generation and separation

Type II BBO OPO and separation optics

Optional OPO 2nd harmonic generation

Schematic shows the compact arrangement of the combined pump laser and Aurora II Integra OPO in a single housing.

The Aurora II Integra OPO

High efficiencies are achieved by employing a double pass pump configuration in an elegant and yet robust design. The reliability is further enhanced by using coated and temperature stabilised crystals in a sealed housing to ensure the longevity of the system. Changes in the crystal tuning angle lead to small changes in the beam direction due to beam translation, so compensation for beam translation is provided as standard to maintain the output beam direction which is useful in pointing sensitive applications such as fibre coupling.

Wavelengths are available in a continuously tunable range from 410nm to 2600nm and this can be extended into the UV with a rail-mounted, compact second harmonic housing. The UV extension frequency doubles the output from the OPO to cover the wavelength range of 210nm to 410nm and further broadens its capability. Users can separate the fundamental and harmonic outside of the laser head for simultaneous access to both, or choose the built-in Pellin Broca option for UV-only output from the laser head.

Both the pump laser and the compact OPO are controlled and tuned via the intuitive computer interface that adjusts the angle of the BBO crystal using high resolution stepper motors. Automatic closed loop tuning is available as an option using an in-built spectrometer and a feedback loop that automatically adjusts the OPO crystal angle to achieve the specified wavelength.

The entire system requires minimal adjustment due to the integrated Invar optical rail construction delivering excellent output stability as standard. Optional auto-stabilisation and auto-tuning of the 355nm pump laser provide an additional level of automation and long-term stability control for continuous operation and industrial applications. The Aurora II Integra uses a highly modular system component design that is suitable for customised solutions tailored to the user's individual needs.

TECHNICAL DATA

Model	Aurora II 15	Aurora II 30	Aurora II 45
OPO			
Wavelength Range (1)			
Signal (nm)	410-710	410-710	410-710
Idler (nm)	710-2300	710-2300	710-2300
SH generator (nm)	210-410	210-410	210-410
Output Pulse Energy			
OPO (mJ) (2)	15	30	45
SH generator (mJ) (3)	2	4	6
Linewidth (cm^{-1}) (4)	<3	<3	<3
Pulse Stability (RMS%) (5)	<4	<4	<4
Scanning Step			
Signal (nm)	~0.01	~0.01	~0.01
Idler (nm)	~0.5	~0.5	~0.5
Pulse duration (ns) (6)	5-7	5-7	5-7
Beam diameter (mm) (7)	5	5	6
Polarisation			
Signal beam	vertical	vertical	vertical
Idler beam	horizontal	horizontal	horizontal
Pump Laser			
Repetition rate (Hz) (8)	10-30*	10-30*	10-30*
Pump wavelength (nm)	355	355	355
Max. pump pulse energy (mJ)	70	135	240
Pulse duration (ns)	6-10	6-10	6-10
Pulse stability (±%) (9)	4	4	4
Services			
Voltage (VAC)	220-250	220-250	220-250
Frequency (Hz)	50/60	50/60	50/60
Power phase	single	single	single
Operating amb. temp (°C)	5-35	5-35	5-35
Laser cooling	see table**	see table**	see table**

Model	
Air	
Max. air temp (°C)	35
Min. air temp (°C)	5
Humidity % (non-condensing)	0-80
Ambient heating (kW)	<2
Water	
Max water temp (°C)	20
Nominal flow rate (lpm)	4-6
Min water pressure (Bar [psi])	2 [30]
Max water pressure (Bar [psi])	4.5 [65]

*** High frequency versions available for 50Hz & 100Hz.**
**** Air and water cooled versions available** (see table).

APPLICATIONS

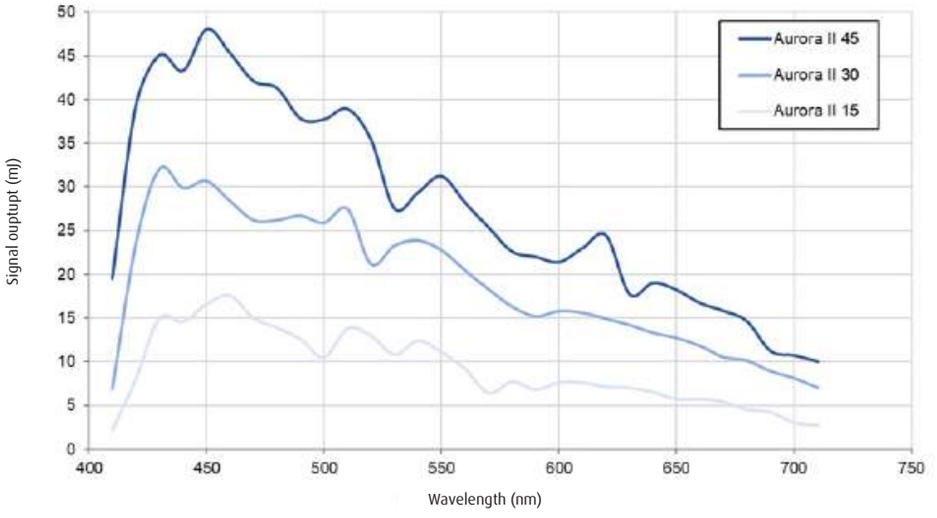
- ***Photoacoustic Imaging***
- ***Laser Induced Fluorescence***
- ***Photobiology***
- ***High Resolution Spectroscopy***
- ***Non Linear Spectroscopy***
- ***LIDAR & Remote Sensing***
- ***Process Monitoring***
- ***Combustion Research***
- ***Display Manufacture and Testing***

1. Optional hands free tuning range 210nm-2600nm.
2. Signal at 450nm. See graphs for output at other wavelengths.
3. Signal at 210nm.
4. Linewidth <3cm^{-1} for 450nm<λ<710nm. 2HG linewidth is <8cm^{-1} for 210nm<λ<355nm range.
5. RMS % stability at 450nm. See graph for stability at other wavelengths.
6. FWHM – Measured with fast photodiode and 300MHz oscilloscope.
7. Measured near field, 1/e^2 diameter at 450nm.
8. Repetition rates up to 100Hz are available, please see table.
9. Peak-to-Peak Energy 99% of pulses.

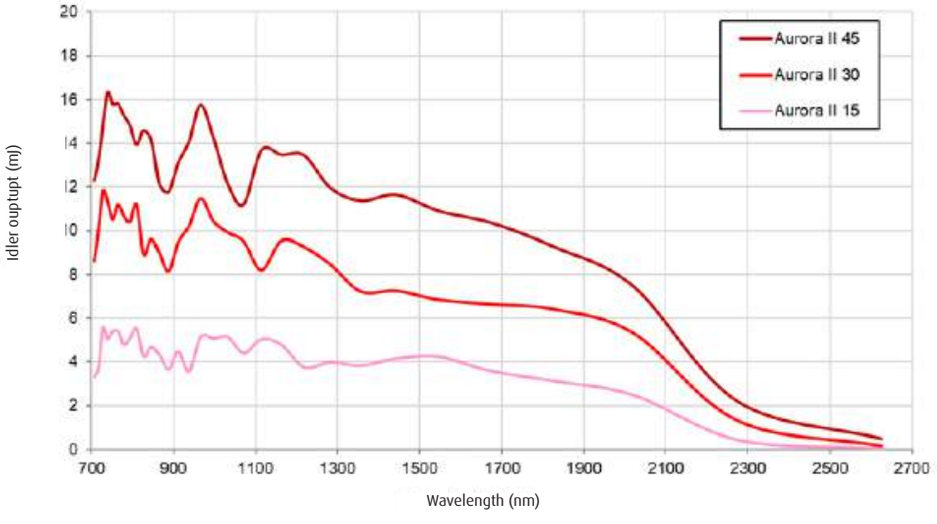
All data provided within this table is for 10Hz models.

SYSTEM PERFORMANCE

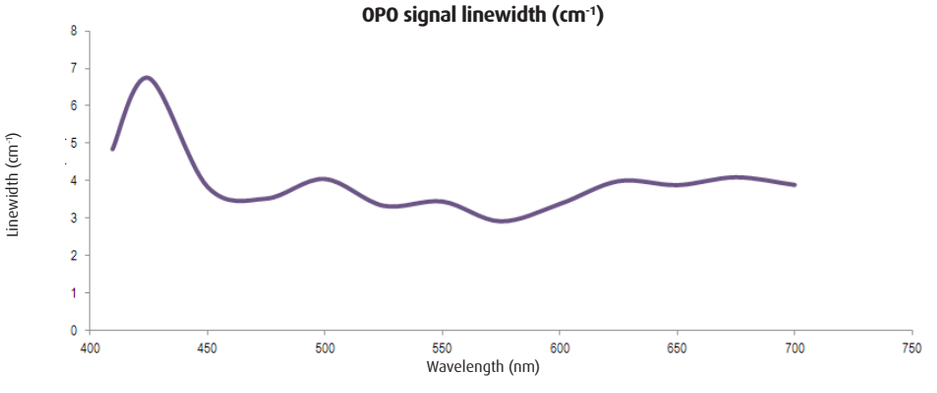
Typical signal output over tuning range 410-710nm



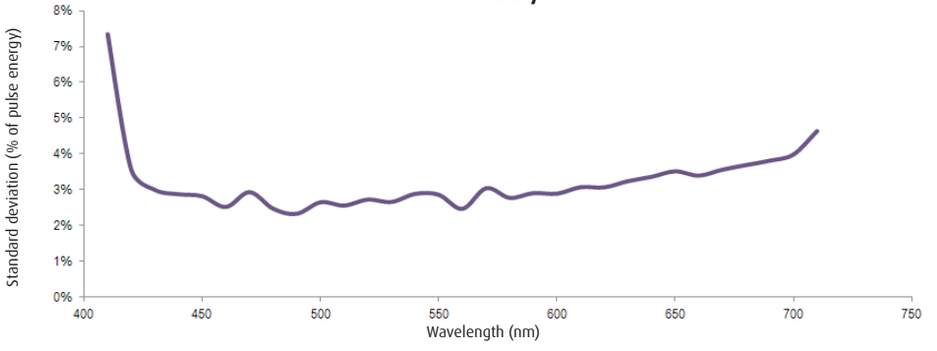
Typical idler output over tuning range 710-2600nm



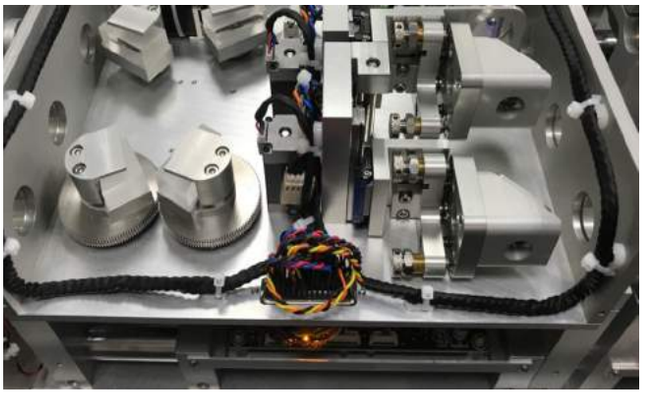
OPO signal linewidth (cm^{-1})



OPO stability



Aurora UV Module - optional access to UV wavelengths



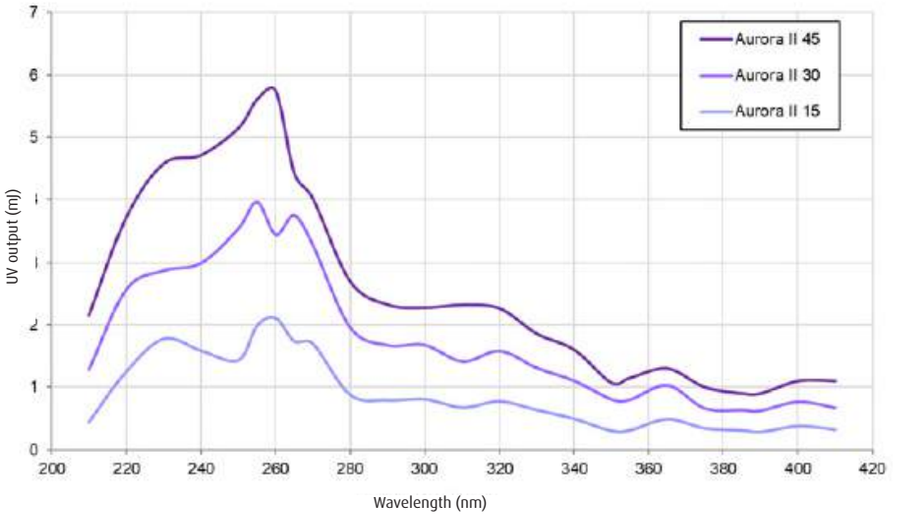
The fully integrated and motorised Aurora UV module extends the Aurora performance into the UV range. The UV module is controlled via the standard software for simple, responsive control. A spectometer, internally mounted within the OPO (1), provides closed loop feedback to automatically tune to the selected wavelength. Alternatively, the user can tune manually the OPO in steps using the jog up/down buttons in the software.

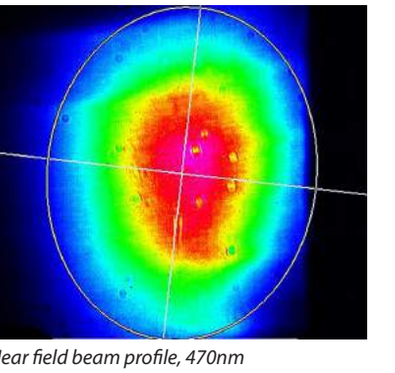
The UV range from 210nm to 410nm is generated by frequency doubling of the signal (4) and idler (5) beams. Both the signal and idler have separate motorised mirror movers (2&3) which allow each beam to exit from the front port of the laser or, alternatively, be diverted (6) through the UV doubler (7&8).

A motorised four prism arrangement (9-12) with internal beam blocks is used to separate the UV from the fundamental wavelength. Pellin-Broca prisms used in this way give a very pure separation of the wavelengths. The prisms also allow for fine optimisation for maximum energy and accurate positioning of the output beam.

1 - OPO
2 & 3 - mirror movers
4 - signal
5 - idler
6 - steering mirror
7 & 8 - doubling crystals
9-12 - motorised Pellin-Broca separators

Typical UV output over tuning range 210-410nm





Near field beam profile, 470nm

Aurora TRLi OPO

Pulsed Nd:YAG high energy compact laser and 532nm pumped OPO

FEATURES

- *Modular OPO for TRLi lasers*
- *10 - 200Hz repetition rate*
- *Tuning range 670-2600nm*
- *Linewidth 2-6cm^{-1}*
- *Motorised OPO tuning*
- *Full PC control via RS232*
- *OPO attenuator*
- *Fibre coupling option*
- *2HG option (335-650nm)*
- *Ultra high stability pump laser <0.3% RMS*
- *Motorised auto-tuning of pump laser*
- *Optional spectrometer*

The **Aurora II TRLi OPO** combines a 532nm pump generation, variable attenuator and Type II BBO OPO into a single compact module that can be attached to any of Litron's TRLi series of Nd:YAG lasers to provide tunable no-gap output in the 670 to 2600nm range.

Incorporating design features used throughout Litron's Aurora OPOs, the TRLi module provides high stability, narrow linewidth and simultaneous signal and idler output in a self-contained unit that is interchangeable with the other harmonic units within the TRLi range. With little to no realignment required on reattachment, the TRLi OPO expands the output of these high energy compact lasers into the NIR range without losing the flexibility of accessing the Nd:YAG harmonics.

Aurora TRLi OPO can be provided with a flashlamp or diode pumped source.

APPLICATIONS

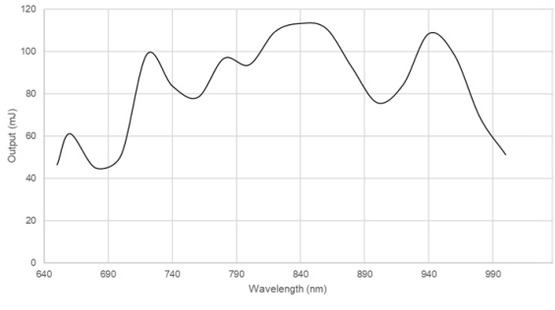
- *Photoacoustic Imaging*
- *Laser Induced Fluorescence*
- *Photobiology*
- *Spectroscopy*
- *LIDAR & Remote Sensing*
- *Process Monitoring*
- *Display Manufacture and Testing*

TECHNICAL DATA

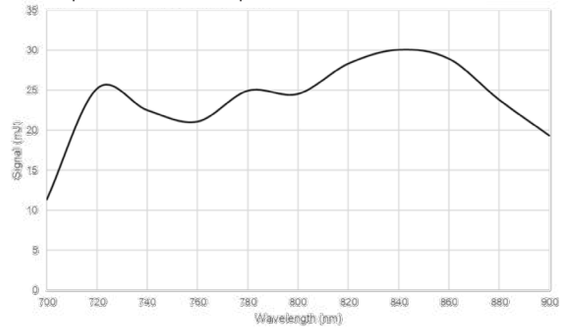
Model	Aurora TRLI OPO	Aurora TRLI DPSS OPO
OPO		
Wavelength Range		
Signal (nm)	670-1064	670-1064
Idler (nm)	1064-2600	1064-2600
SH generation (nm)	335-650	335-650
Output Pulse Energy		
OPO (mJ) at 840nm		
10Hz	100	N/A
100Hz	N/A	up to 20
200Hz	N/A	up tp 15
Parameters		
Linewidth (cm^{-1})	2-6	2-6
Output Stability (% RMS)	≤2	≤2
Pulse Width (ns)	4-7	4-7
PUMP LASER	**Lamp Pumped**	**Diode Pumped**
Repetition rate (Hz)	10-50	50-200
Pump wavelength (nm)	1064	1064
Services		
Voltage (VAC)	220-250	220-250
Frequency (Hz)	50/60	50/60
Power phase	single	single
Operating amb temp (°C)	10-30	10-30
Laser cooling	Chiller	Chiller

TYPICAL OUTPUTS

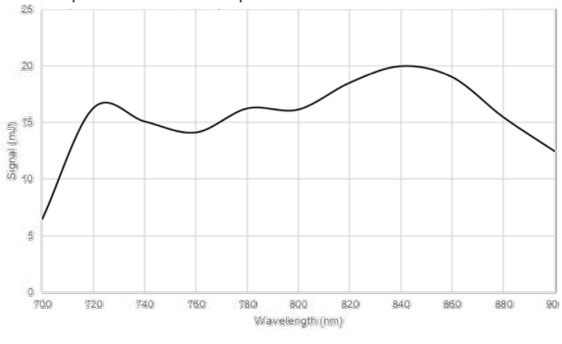
Output with 10Hz flashlamp operation



Output with 100Hz DPSS operation



Output with 200Hz DPSS operation



Aurora 1.57

Fully integrated 1.57µm OPO and 1064nm pump laser system

FEATURES

- ***Sealed single body laser head***
- ***Rugged and industrial design***
- ***Fully detachable connections***
- ***Water-to-air cooled PSU***
- ***Full PC control***

APPLICATIONS

- ***Laser Absorption Spectrometer***
- ***Remote Sensing***
- ***LIDAR***
- ***Sensor Diagnostics***
- ***Metrology***

The **Aurora 1.57** is a 1064nm pulsed Nd:YAG laser with a fixed wavelength OPO optimised for 1.57µm operation. The laser resonator and OPO are mounted together in a single solid body to ensure permanent alignment between the two components.

Active temperature control of the OPO crystal and pump laser ensures long term energy stability.

The laser head is sealed against environmental contamination to IP54 rating and is fully detachable at both the laser head and power supply. The exit port window can be easily replaced by the user if required.

Using the LPU series power supply, the laser power and control system and closed-circuit water-to-air cooling system are combined in a compact standalone unit. This can be provided either as a free-standing, or a rackmounted unit. The system is controlled either via RS232 with the supplied software suite or using the LUCi touchscreen remote control. External triggering of the lasers is available via a TTL interface.

TECHNICAL DATA

Model	A-1.57 50-10	A-1.57 30-30
Max. Repetition Rate (Hz)	10	30
Wavelength (µm)	1.57	1.57
Output Pulse Energy		
OPO (mJ) [1]	50	30
Pulse stability (RMS %) [2]	<6	<6
Polarisation		
Single beam	linear	linear
Parameter		
Beam diameter (mm) [4]	6.5	5
Pulse length @ 1.57µm (ns) [3]	10-12	10-12
Pointing stability (µrad)	<100	<100
Resonator type	stable	stable
Lamp life (pulses)	$5x10^7$	$5x10^7$
Timing jitter (ns)	<0.5	<0.5
Services		
Voltage (VAC)	90-250	220-250
Frequency (Hz)	47/63	47/63
Power phase	single	single
Operating amb. temp (°C)	5-35	5-35
Consumption (W)	350	650
PSU type	LPU350 [5]	LPU1000 [6]

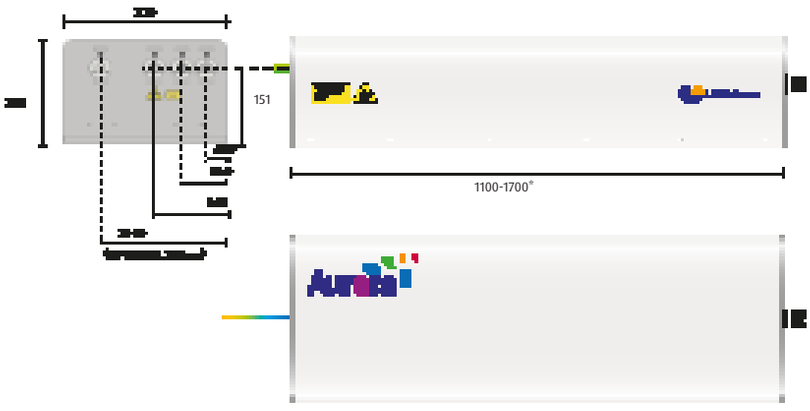
Cooling Requirements	
Max. air temp (°C)	35
Min. air temp (°C)	5
Humidity % (non-condensing)	0-80
Ambient heating (kW)	<2

1. Signal at 1.57µm.
2. RMS % stability.
3. FWHM - Measured with fast photodiode and >1GHz oscilloscope.
4. Measured near field, $1/e^2$ diameter.
5. LPU350R - Optional 19 inch rackmount PSU (4U) available.
6. LPU1000R - Optional 19 inch racmount PSU (7U) available.

MECHANICAL DATA

All dimensions in mm unless stated.

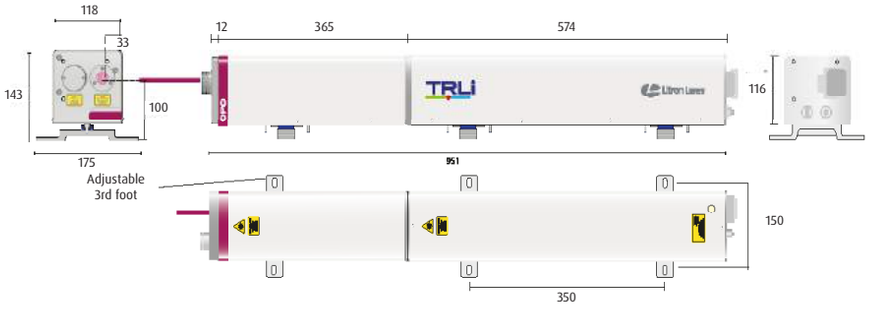
Aurora II Integra



Dimensions	
Laser Head	
(mm)	326 (W) x 209 (H) x 1100* (L)
(Inches)	12.8 (W) x 8.2 (H) x 43.3* (L)
PSU	
LPU350 (mm)	605 (W) x 700 (D) x 615 (H)
(Inches)	23.8 (W) x 27.5 (D) x 24.2 (H)
or(*)	
LPU1000 (mm)	238.5 (W) x 502 (D) x 615 (H)
(Inches)	9.4 (W) x 19.7 (D) x 24.2 (H)

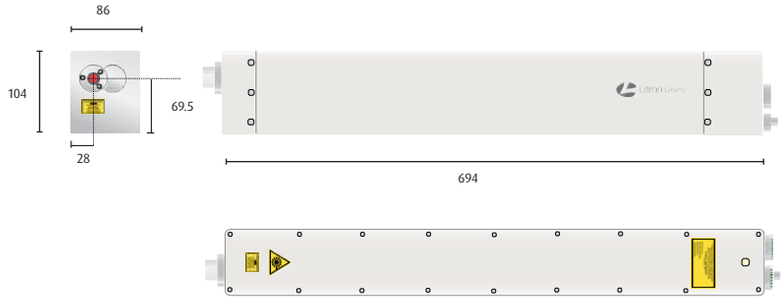
* Depending on laser system options.

Aurora TRLi OPO



Dimensions	
Laser Head	
(mm)	118 (W) x 143 (H) x 951 (L)
(Inches)	4.64 (W) x 4.09 (H) x 37.44 (L)
PSU	
LPU1000 (mm)	238.5 (W) x 502 (D) x 615 (H)
(Inches)	9.4 (W) x 19.7 (D) x 24.2 (L)

Aurora 1.57



Dimensions	
Laser Head	
(mm)	86 (W) x 104 (H) x 694 (L)
(Inches)	3.38 (W) x 4.1 (H) x 27.3 (L)
PSU	
LPU350 (mm)	202 (W) x 382 (D) x 430 (H)
(Inches)	7.95 (W) x 15 (D) x 16.9 (H)
or(*)	
LPU1000 (mm)	238.5 (W) x 502 (D) x 615 (H)
(Inches)	9.4 (W) x 19.7 (D) x 24.2 (L)

* Depending on laser system options.

Our policy is to improve the design and specification of our products. The details given in this document are not to be regarded as binding.

ADVANCED CERTIFICATION ISO 9001:2015

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